I-405 & SR 167 INTERCHANGE GRADE SEPARATION RAMP EVALUATION

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Overview

The Washington State Department of Transportation opened a new grade separation exit ramp from Interstate 405 southbound to southbound State Route 167 on April 6th, 2003. Since the project's completion, southbound I-405 traffic volumes have increased significantly. Despite the volume growth, congestion has markedly decreased during weekday evenings and middays, as well as on weekends. The grade separation project has improved southbound I-405 traffic conditions and enabled more motorists to make use of the freeway.

Background

Prior to the grade separation project, the I-405 & SR 167 interchange was a classic cloverleaf configuration with collector-distributor lanes paralleling both directions of
I-405. Traffic exiting the collector-distributor from southbound I-405 crossed traffic entering the C-D from northbound SR 167. This weaving movement caused a significant bottleneck, triggering congestion on both southbound I-405 and northbound SR 167 as well as increasing the potential for accidents. The grade separation project eliminated that weaving movement by building a separate elevated lane for traffic heading to southbound SR 167.

Although completion of the new flyover ramp was the project's most visible improvement, it was not the only one. Shortly after the project began in September 2001, the slip ramp from southbound I-405 to northbound SR 167 was separated from the southbound I-405 to southbound SR 167 ramp in order to improve traffic flow. Figures 1 and 2 illustrate the interchange's configuration before and after the project.

This project was designed to reduce accidents and improve traffic flow by eliminating the weaving motion on the southbound collector-distributor. WSDOT traffic engineers expected the project to cut accidents on the C-D by 30 percent. The project was also intended to reduce congestion on southbound I-405 and northbound SR 167 during non-peak weekday hours and on weekends. However, it was not expected to reduce congestion during peak weekday hours or on the other ramps of this interchange.

Figure 1: Interchange Configuration Before Grade Separation Project

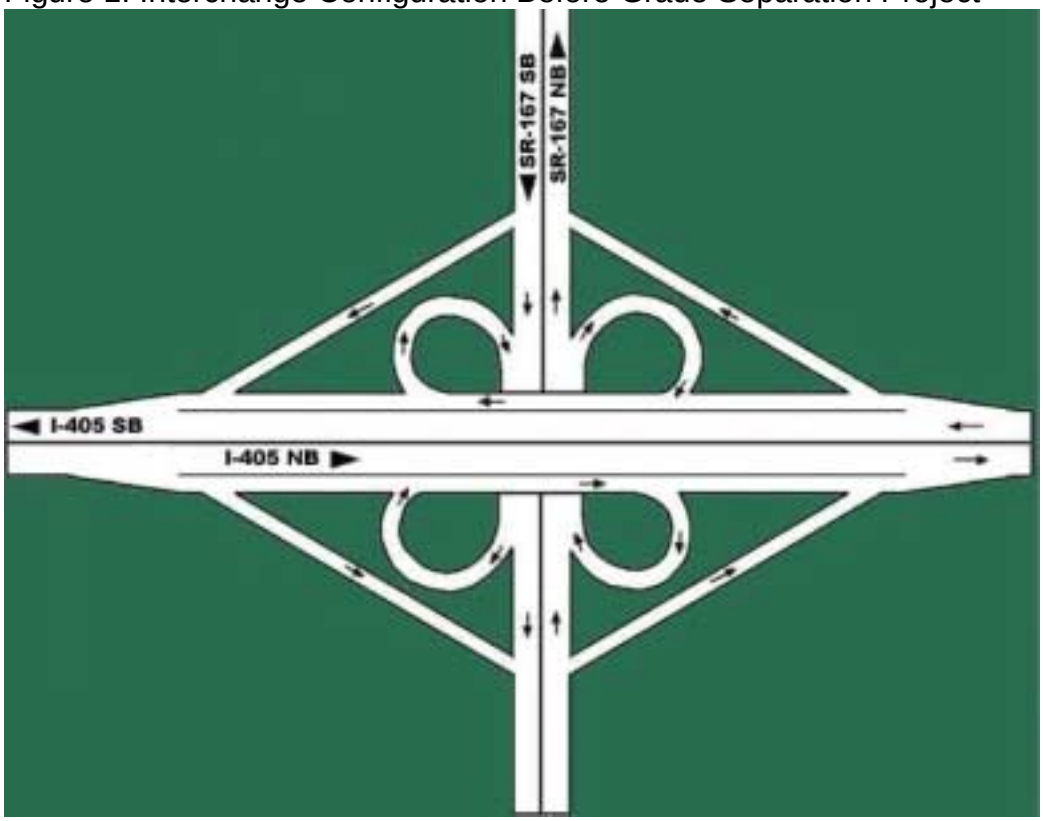
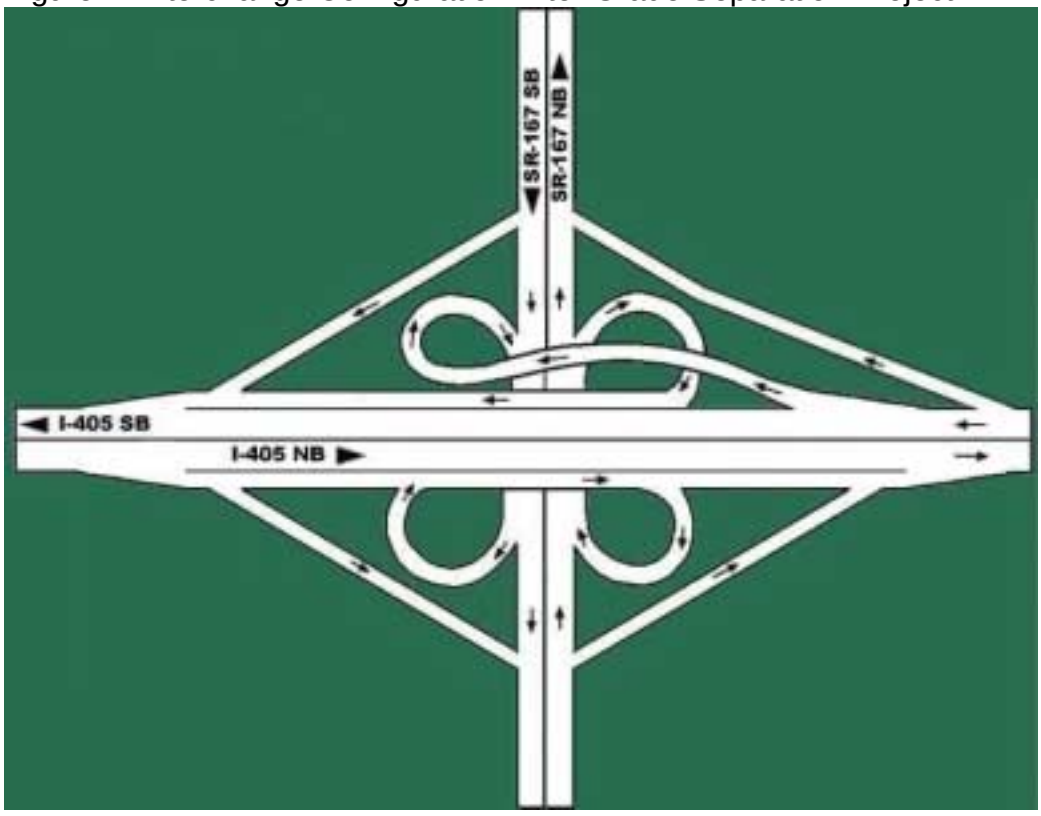


Figure 2: Interchange Configuration After Grade Separation Project



Data Collection

WSDOT evaluated traffic on southbound I-405 and the new flyover ramp using data collected by vehicle sensor loops imbedded in the roadway. The study's *after* data were taken from April 2004, 1 year after completion of the grade separation ramp. In order to eliminate seasonal variations, April 2001 figures were used as *before* data. Weekday study dates included Tuesdays, Wednesdays, and Thursdays; Saturdays were used for all weekend analyses. Days with major incidents along the I-405 or SR 167 corridors were omitted from this study.

This project was completed too recently for a statistically meaningful accident analysis.

Weekday Results

Congestion

Congestion is often quantified using a measurement called *loop occupancy,* the percentage of time that a loop detector is activated (or occupied) by vehicles traveling over it. Loop occupancy was used to generate average congestion graphs for southbound I-405 between NE 30th Street and Southcenter.

As Figures 3 and 4 illustrate, weekday congestion generally improved following completion of the interchange project. The intermittent periods of heavy congestion near Cedar Avenue between 9:30 and noon have been eliminated since the project's completion. This reduction of midday traffic confirmed planners' expectations of off-peak improvements. The congestion decreases during most of the evening commute were not expected.

In April 2001, a mile-long segment of stop-and-go congestion typically extended through the Renton S-curves from 1:30 to 6 pm. Although congestion in that area during April 2004 remained heavy, the stop-and-go conditions were reduced to a few intermittent periods stretching only half a mile. The extent of afternoon heavy congestion was greatly reduced, even though it's duration changed little. Prior to the interchange project, heavy congestion often reached the NE 30th Street area, near milepost 6.5. After the flyover ramp's completion, heavy conditions extend only to Sunset Boulevard, nearly two miles south of NE 30th.

Morning conditions worsened slightly between April 2001 and 2004. Periods of heavy and stop-and-go congestion both increased, though not substantially. These increases may be due to volume growth following the project's completion.

Figure 3: I-405 Southbound Weekday Congestion (April 2001)

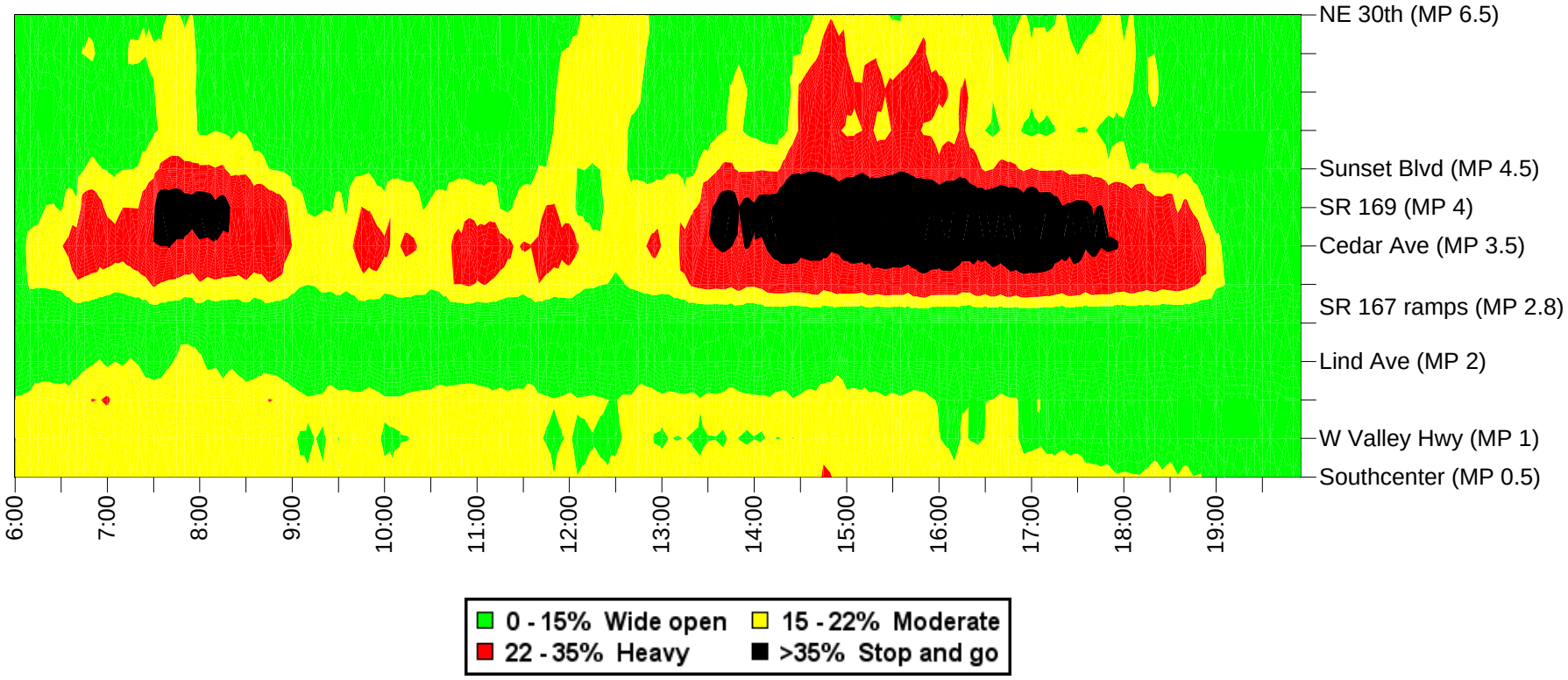
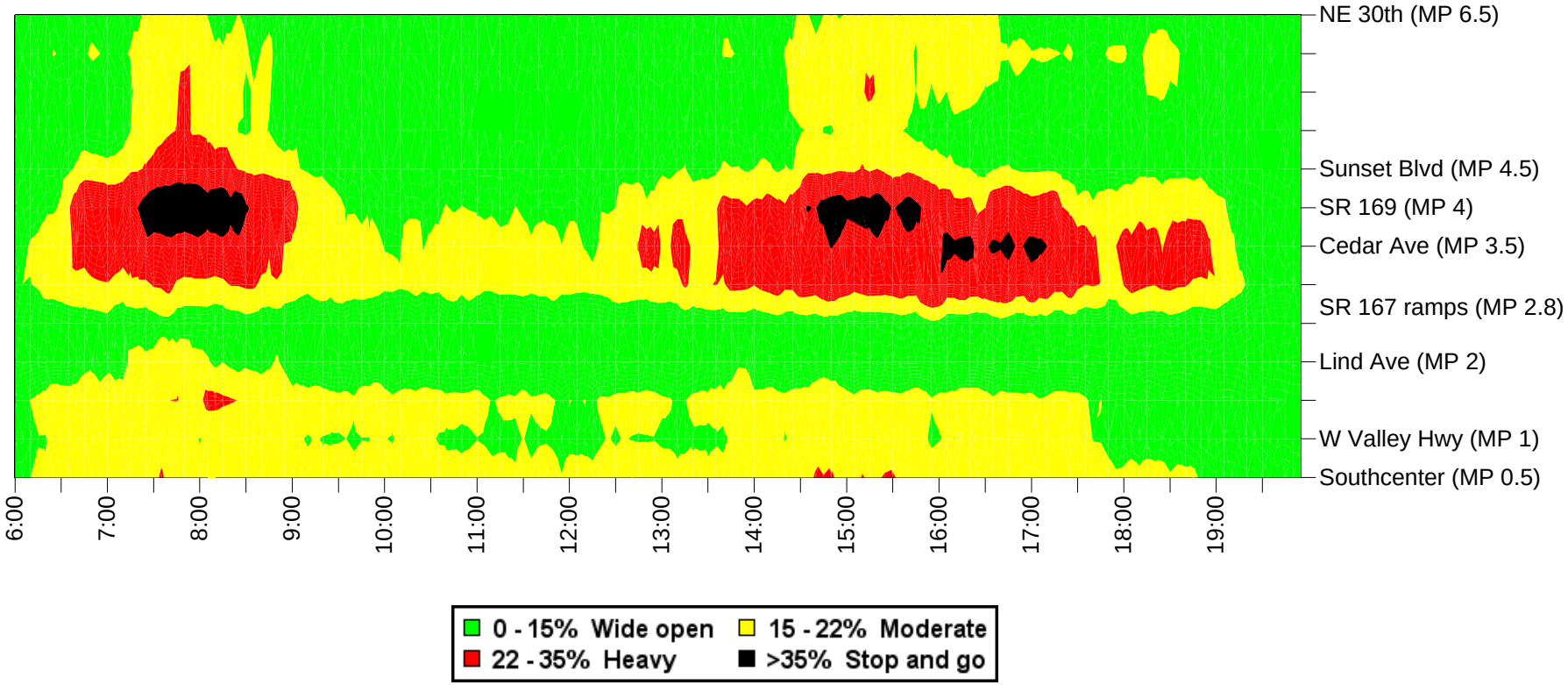


Figure 4: I-405 Southbound Weekday Congestion (April 2004)



Volume

Southbound I-405 traffic volumes rose significantly between 2001 and 2004 despite congestion reductions. These trends are shown in Figure 5, a two-axes graph displaying volume and loop occupancy at Cedar Avenue. *After* volumes exceeded *before* for every 15-minute interval between 6:30 am and 7 pm. The increase was greatest during the heart of the evening commute, when 2001 volumes dropped dramatically because of the inefficiency of stop-and-go congestion. Since evening congestion decreased following the interchange project, the freeway's efficiency increased and I-405 carried many more vehicles.

Figure 5 again illustrates the trends first demonstrated in Figures 3 and 4. Morning traffic conditions changed very little; midday and evening congestion improved considerably.

Tables 1 and 2 give the hourly volumes for southbound I-405 at Benson Road and for the exit ramp to southbound SR 167, respectively. Mainline volumes increased by 7% between 2001 and 2004, while even more significant volume growth occurred on the reconstructed exit ramp.

Daytime volumes on the new flyover ramp exceed those from before construction by nearly 3,400 vehicles, a 17% rise. Some of this increase may be attributable to a reduction in cut-through traffic on surface streets. Because of I-405's severe evening congestion prior to the interchange project, many motorists exited the freeway north of the interchange and made their ways to SR 167 on Renton city streets. With the project's traffic improvements, I-405 became a more attractive option and some drivers abandoned their arterial shortcuts. Due to the lack of traffic detectors on surface streets, a quantitative analysis of cut-through traffic reduction is beyond the scope of this report.

Figure 5: I-405 Southbound Weekday Volume and Congestion

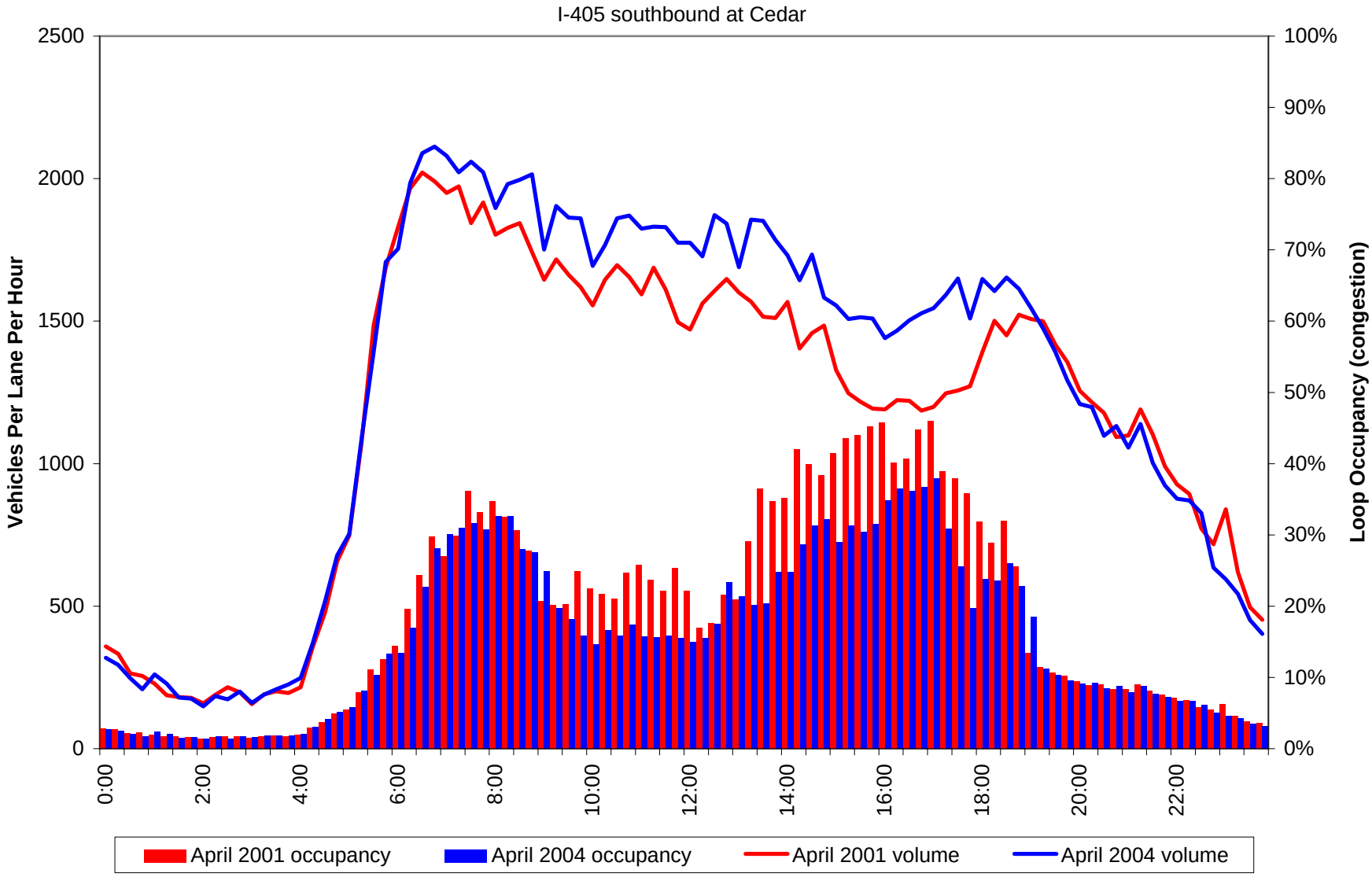


Table 1: Weekday hourly volumes on I-405 southbound at Benson Rd

	April 2001	April 2004	Difference
6:00	4406	4549	143
7:00	4446	4740	295
8:00	4183	4546	363
9:00	3823	4163	340
10:00	3836	3972	135
11:00	3830	4017	187
12:00	3628	4056	428
13:00	3809	4241	432
14:00	3998	4267	269
15:00	3812	4265	453
16:00	3753	4258	504
17:00	3770	4136	366
18:00	4039	4119	80
19:00	3374	3514	139
20:00	2686	2770	84
Sum	57393	61611	4218

Daytime volume increased by about 7 %.

Table 2: Weekday hourly volumes on I-405 southbound to southbound SR 167 ramp

	April 2001	April 2004	Difference
6:00	1276	1473	198
7:00	1244	1536	292
8:00	1207	1456	248
9:00	1172	1399	227
10:00	1176	1368	192
11:00	1194	1440	245
12:00	1194	1465	271
13:00	1267	1577	309
14:00	1330	1587	256
15:00	1293	1599	306
16:00	1324	1607	283
17:00	1314	1605	290
18:00	1413	1533	120
19:00	1282	1369	87
20:00	998	1063	65
Sum	18684	22075	3390

Daytime volume increased by about 17%.

Weekend Results

Congestion

Saturday congestion diminished dramatically following completion of the project, confirming planners' forecasts. As Figures 6 and 7 show, heavy or stop-and-go congestion typically extended northward through the S-curves from noon until 3 pm prior to the interchange project. Heavy conditions have all but disappeared since the flyover ramp's opening. Although moderate congestion still occurs during much of the day, the heaviest conditions rarely flare up.

Volume

Weekend traffic volumes increased even more than weekday volumes. From April 2001 to April 2004, volumes between 6 am and 9 pm rose by nearly 6,400 vehicles, or 14%. Figure 8 illustrates these changes. Just as they did on weekday evenings, volumes in 2001 dipped during the period of heaviest congestion (between noon and 3 pm). Afternoon congestion dropped following the interchange project, allowing volumes to increase significantly.

Figure 6: I-405 Southbound Saturday Congestion (April 2001)

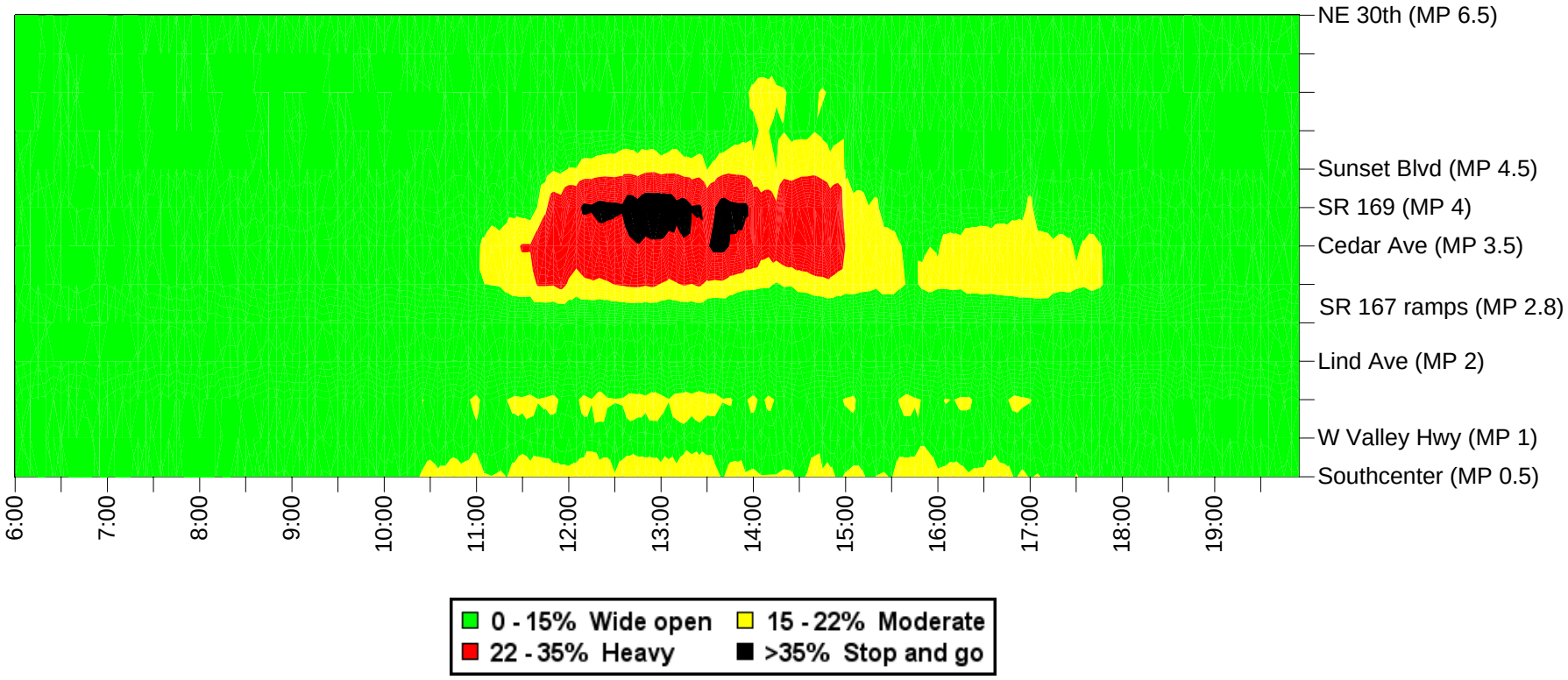


Figure 7: I-405 Southbound Saturday Congestion (April 2004)

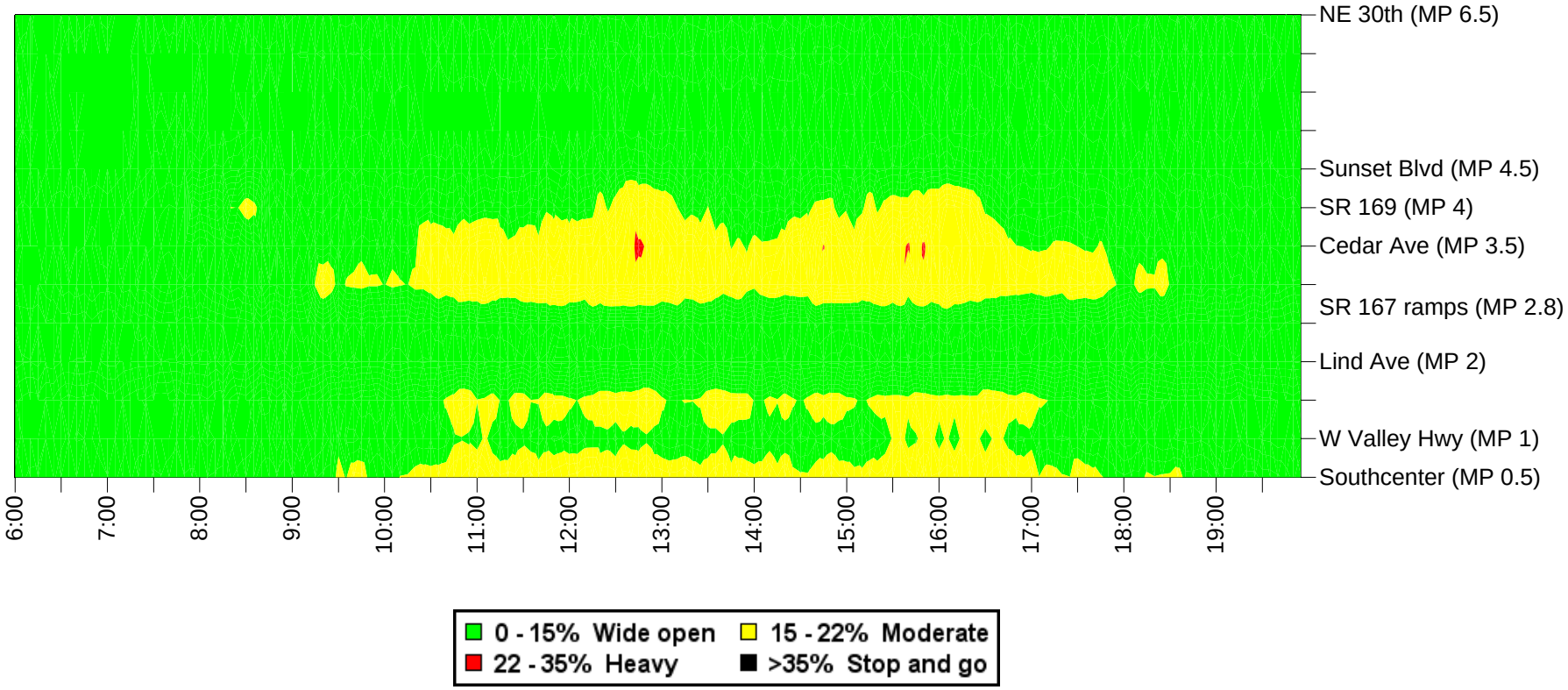


Figure 8: I-405 Southbound Saturday Volume and Congestion